REMARKS

Applicants' representative would like to thank Examiner Umez-Eronini for the courteous and helpful discussion of May 18, 2004. During this discussion applicants' representative pointed out that the oxide etching chemistry of Huang et al is the same as the nitride etching chemistry of Chen et al, and therefore substituting the oxide etching chemistry of Huang et al into Chen et al will not give "an oxide etching chemistry that is different from the nitride etching chemistry" as specified in claims 1 and 19 of the present application. Applicants' representative also pointed out that Chen et al alone describes switching to the oxide etching chemistry during the overetching of the nitride layer and continues using this oxide etching chemistry until etching through the pad oxide, and therefore Chen et al alone does not include "overetching the nitride layer using the nitride etching chemistry" as specified in claim 31.

Claims 1-6, 8-23 and 31-38 are present and active in the application. All other claims were cancelled.

Shallow trench isolation (STI) allows the fabrication of isolation trenches in semiconductor devices without the undesirable Beard's Beak formation. Usually an STI is made by forming a pad oxide layer over a silicon layer, depositing a nitride layer on the pad oxide layer, and then depositing a photoresist on the nitride layer. The photoresist is patterned with photolithography and then the nitride layer, the oxide layer, and the silicon layer are etched, forming the trench. The performance of STI devices can be adversely affected by the presence of sharp bottom corners and sharp top corners in the trench. In addition, defects may be introduced such as micromasking structures, which may be caused by residual polymeric material produced from the etching chemistries used to etch the nitride layer and the pad oxide layer. The present invention addresses these disadvantages.

Claims 1, 19 and claims dependent thereon, specify that the oxide etching chemistry comprises CF_4 and CHF_3, and which is different from the nitride etching chemistry. Claims 31-38 specify a nitride overetch that uses the nitride etching chemistry.

The rejections of claim 1-6 and 8-23 under 35 U.S.C. 103 over Chen et al in view of Huang et al, and optionally further in view of Kim, Bhardwaj, or Kosugi, are

respectfully traversed. Huang et al describes an oxide etching chemistry that is the same as the nitride etching chemistry of Chen et al.

Chen et al describes forming top rounding in a shallow trench etch. The nitride etching chemistry includes four gasses: methane trifluoride (CHF_3), carbon tetrafluoride (CF_4), argon (Ar) and oxygen (O_2) (col. 3, lines 1-13). The chemistry of the nitride overetching and the oxide etching are the same, and use three gasses: methane trifluoride (CHF_3), methane monofluoride (CH_3F), and argon (Ar) (col. 3, line 22-37). There is no suggestion to use carbon tetrafluoride (CF_4) in the oxide etching chemistry.

Huang et al describes a method for STI top rounding control. After forming a hard mask of silicon nitride and an oxide layer, the photoresist is patterned and the nitride layer and the oxide layer are etched with a mixture of $CHF_3/CF_4/O_2/Ar$ or SF_6/CHF_3 (col. 2, lines 36-51). The first of these mixtures, which includes carbon tetrafluoride (CF_4), is the same as the nitride etching chemistry of Chen et al.

Kim, Bhardwaj and Kosugi have only been cited for elements of the dependent claims.

Claims 1, 19, and claims dependent thereon, specify oxide etching chemistry that comprises CF_4 and that the oxide etching chemistry is different from the nitride etching chemistry. Chen et al uses oxide etching chemistry that does not contain CF_4, as noted in the office action. The oxide etching chemistry of Huang et al does contain CF_4, but it is the same etching chemistry as the nitride etching chemistry of Chen et al; therefore substituting the oxide etching chemistry Huang et al into Chen et al leads to oxide etching chemistry that is the same as the nitride etching chemistry. Accordingly, combining these two references does not give "an oxide etching chemistry that is different from the nitride etching chemistry" as specified in claims 1 and 19. Kim, Bhardwaj and Kosugi have only been cited for elements of the dependent claims. The invention of claims 1, 19 and claims dependent thereon, is not obvious over the applied references. Withdrawal of these grounds of rejection is respectfully requested.

The rejections of claims 31-38 under 35 U.S.C. 103 over Chen et al alone, or under 35 U.S.C. 103 over Chen et al in view of Kim, Bhardwaj, or Kosugi, are respectfully traversed. Chen et al overetches the silicon nitride layer using oxide etching chemistry, not nitride etching chemistry.

Chen et al is described above. Overetching of the nitride layer is carried out using the etching chemistry of the oxide layer (col. 3, line 22-37).

Kim, Bhardwaj and Kosugi have only been cited for elements of the dependent claims.

Claim 31, and claims dependent thereon, specify "overetching the nitride layer using the nitride etching chemistry . . . ." Chen et al only suggests overetching the nitride layer using the oxide etching chemistry. Accordingly, these claims are not obvious over the applied references. Withdrawal of these grounds of rejection is respectfully requested.

Applicants submit that the present application is now in condition for allowance. Early notice of such action is earnestly solicited.

Respectfully submitted,

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